# 2023 YEAR IN REVIEW

## MAKING OUR VISION A REALITY


National Nuclear Security Administration

- NUCLEAR STOCKPILE
- GLOBAL SECURITY & STABILITY
- NUCLEAR NAVAL PROPULSION
- EMERGING CHALLENGES
- WORLD-CLASS SCIENCE, TECHNOLOGY & ENGINEERING
- ADAPTIVE WORKFORCE & RESILIENT INFRASTRUCTURE
- INTEGRATED ENTERPRISE MANAGEMENT & OPERATIONS


## WEAPONS DELIVERIES

Both the B61-12 and W88 Alt370 programs have reached the 50% completion mark and are on schedule.

In the past year, NNSA delivered more than 200 modernized weapons to the Department of Defense. We are modernizing our stockpile on-schedule and at pace. 1

## KEY PROGRESS ON W87-1 AND W80-4

The W87-1 Modification Program entered Phase 6.3, Development Engineering, and NNSA completed the first W87-1 test and evaluation units. The W87-1 is slated for deployment in the early 2030s. The W80-4 Life Extension Program reached Phase 6.4, Production Engineering, with support from Cost Estimating and Program Evaluation. 2

## PRODUCTION ACHIEVEMENTS AT PANTEX

Pantex authorized and completed the first production unit for the W88 Alt 940 Program; achieved 99.5% of FY 2023 baseline goals; reduced production downtime; and completed 103% of the production baseline requirements and increased output by over 72% in one year.


## U.S.-U.K. PARTNERSHIP

NNSA achieved deeper cooperation under the U.S.-U.K. Mutual Defense Agreement across the following priority areas: Future System Options, Predictive Capability, Integrated Engineering and Science, Modern Production Environment, Infrastructure Modernization and Revitalization, and Workforce Investment.

## 20 YEARS OF JASPER

This year marked the 20th anniversary of the Joint Actinide Shock Physics Experimental Research Facility, or JASPER. The JASPER team has completed 193 shots, providing more than two decades of precise plutonium performance data. 3

## DISMANTLEMENT, DISASSEMBLY, AND BUILDS AT Y-12

Y-12 completed 100% of its dismantlement and 108% of its disassembly milestones while meeting supporting part and material stream recycling needs for future program builds. It also delivered six campaigns of material in support of Naval Reactors feedstock production, and the first campaign of FY 2024 was staged for delivery ahead of schedule.


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## PROGRESS ON MK21

Sandia completed final design qualification testing of Mk21 Arming Fuzing Assembly major components and supported the Flight Test Unit 4 build process and early delivery of the assembly to meet a critical flight test schedule for the U.S. Air Force. 4

## SAFE TRITIUM SHIPMENTS

The Savannah River Field Office provided effective safety oversight of Tritium shipments to the Defense Department, 100% on time with zero defects. The Savannah River Site performed six extractions, received a record-high 11 TPBAR casks from TVA, and completed advanced planning and procurement for the CY25 outage that will replace significant infrastructure. 5


## SUPPORT TO UKRAINE

NNSA directly reduced nuclear risks in Ukraine stemming from Russia's aggression by conducting analysis and planning to respond to nuclear emergencies, strengthening the resilience of Ukraine's nuclear power plants, continuously monitoring the status of Ukraine's nuclear facilities, and providing training and technical guidance to Ukrainian personnel. In ongoing collaborations with partners in Ukraine — to include the National Guard, State Border Guard Service, and National Police — NNSA continues to deliver equipment, training, and technical advice for their interdiction and identification of radioactive and nuclear material outside of regulatory control. 6

## ADVANCING INCIDENT PREPAREDNESS

NNSA advanced radiological and nuclear emergency preparedness and response capabilities domestically and overseas by conducting 50 virtual or in-person training events with state, local, and international partners. 7

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## ADDING TO NUCLEAR MATERIAL ARCHIVE

NNSA added a significant number of nuclear material specimens to the National Nuclear Material Archive, resulting in a 30% increase in the amount of forensically valuable material in the archive. 8

## REMOVING RADIOACTIVE SOURCES FROM GUATEMALA

Two U.S.-origin high activity radioactive sources were removed from an oncology clinic in Guatemala City. This eliminated the threat posed by material that could be used in a dirty bomb. The effort also facilitated the delivery of eight pallets of backlogged humanitarian aid to Guatemala via unused space on U.S. Air Force flights. 9

## A MOBILE OPTION FOR DOWNBLENDING

NNSA cut the ribbon for the Mobile Melt-Consolidate system, a flexible tool that can be deployed to downblend and treat a wide variety of highly enriched uranium-bearing materials safely and reliably. It provides an innovative solution to eliminate highly enriched uranium inventories that previously lacked a disposition pathway.

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## PROGRESS ON PLUTONIUM DISPOSITION

Following seven years of extensive planning and coordination, NNSA initiated shipments of downblended surplus plutonium from K-Area at the Savannah River Site for final disposition at the Waste Isolation Pilot Plant. This marks a significant achievement for the Plutonium Disposition Program and the site, and demonstrates our commitment to the state of South Carolina.

## IMPROVING NUCLEAR DETECTION

A safe and successful subsurface chemical explosion at the Nevada National Security Site improved our ability to detect low-yield nuclear explosions around the world and will help validate new predictive explosion models and detection algorithms. NNSA teams worked with researchers from across the Nuclear Security Enterprise, the broader U.S. government, and beyond. 10

## ADVANCING SAFEGUARDS VERIFICATION

NNSA led the Lost River Field Test, the first demonstration of Wide Area Environmental Sampling, a potentially powerful additional safeguards verification tool for the International Atomic Energy Agency. The agency's use could support conclusions regarding the absence of undeclared nuclear activities. 11


## HIGH ASSAY LOW ENRICHED URANIUM

Pantex exceeded the High Assay Low Enriched Uranium production goal of 2,500 kilograms; produced more than 90 kilograms of U3O8 material for the High Flux Isotope Reactor; completed low equity discards of 285 items; and supported NNSA events in 26 countries.

## GLOBAL BURST DETECTOR MISSION

Sandia scientists integrated a radiation resilient prototype cognitive computing electrical module into the LEONIDAS and ASTRID missions on the International Space Station to collect earth background data for the NNSA Global Burst Detector treaty monitoring mission. 12

## PUBLIC SAFETY AND SECURITY

NEST provided preventative radiological and nuclear detection and analytic support to 62 national-level security events, including the 2023 State of the Union address, New Year's Eve celebrations in Las Vegas and New York City, Super Bowl LVII, and others. NEST also deployed in support of 11 unscheduled radiological/nuclear incidents. 13




## ADVANCING AUKUS

Through the Naval Nuclear Propulsion Program, which includes U.K. and now Australian participants in support of international partnerships, Naval Reactors has trained 28,155 naval officers, 127,495 enlisted Sailors, and 2,357 civilian specialists throughout FY 2023. 14

## SUPPORTING THE NUCLEAR NAVY

As of the end of FY 2023, Naval Reactors directly supported 78 total active nuclear-powered warships. This includes USS Gerald R. Ford (CVN 78), the world's largest nuclear-powered aircraft carrier, which completed its maiden deployment this year. 15

## COLUMBIA CLASS SUBMARINE

District of Columbia (SSBN 826), the lead ship of the Columbia Class, is under construction with the reactor plant design more than 93% complete. The Columbia Class remains the U.S. Navy's #1 Acquisition Program, and Naval Reactors is on track for on-time completion.

## CHIPS AND SCIENCE ACT HUBS

Sandia National Laboratories and Lawrence Livermore National Laboratory are both part of "hubs" that received Department of Defense Microelectronics Commons awards, part of the CHIPS and Science Act. The hubs will provide a direct pathway to reduce U.S. reliance on foreign microelectronics and accelerate domestic prototyping and growing a pipeline of U.S.-based semiconductor talent.

## EXECUTIVE ORDER ON AI

The White House released the Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence (AI). A key role for DOE, and NNSA specifically, is to develop the AI model evaluation tools and AI testbeds. NNSA will evaluate capabilities to generate outputs that may represent nuclear or other threats and hazards, as well as to guard against these threats. 16

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## NASA TRAINS IN NEVADA

As space becomes increasingly critical to U.S. national security, NASA scientists returned to the site for the first time in over 50 years to train in the site's world-class craters, mimicking lunar terrains. 17

## IMPROVED CLIMATE SIMULATIONS

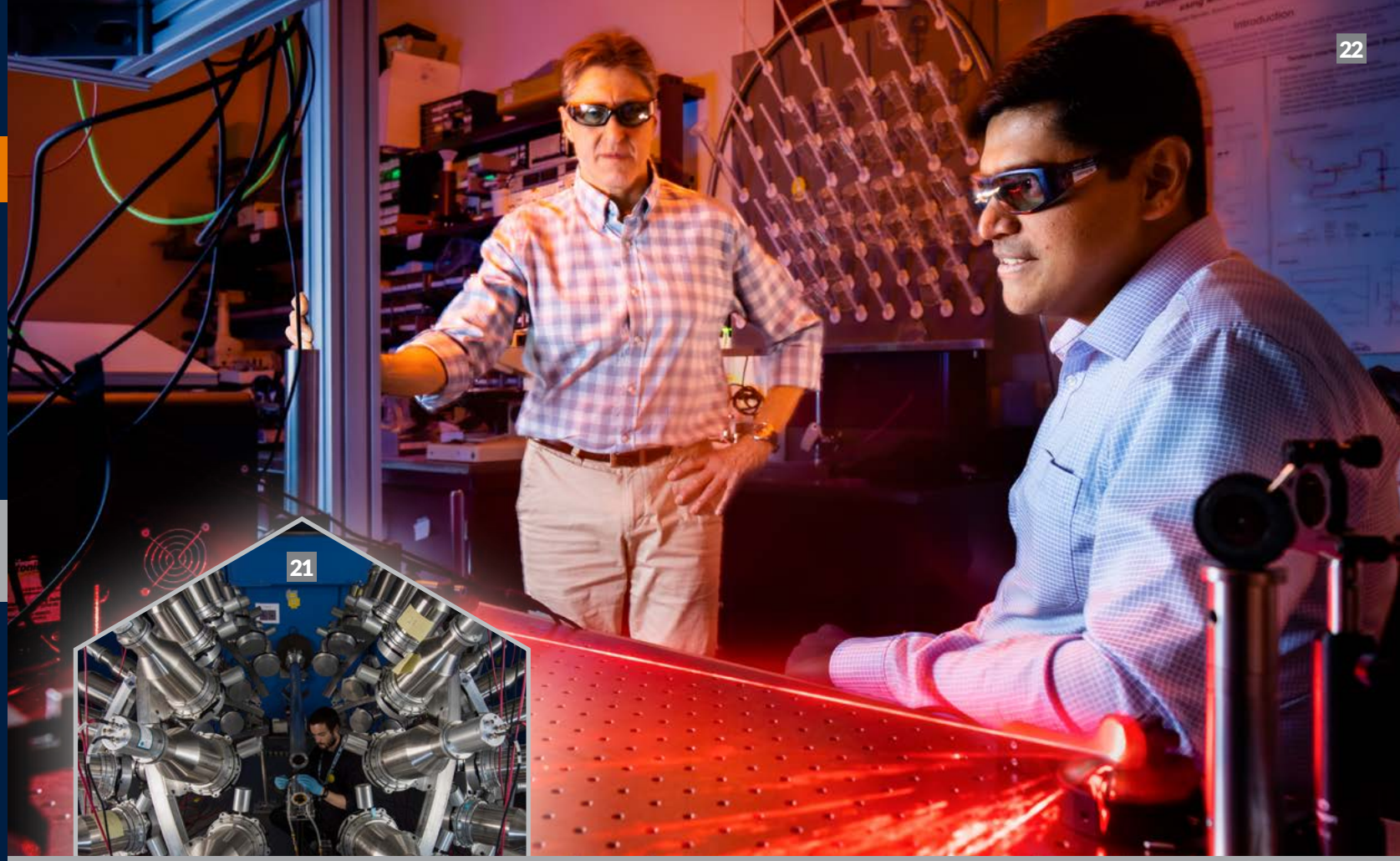
Sandia experts coupled the Simple Cloud-Resolving E3SM Atmosphere Model with the Frontier code to enhance the treatment of clouds in multi-year climate simulations, leading to more accurate model predictions for climate security endeavors. 18


## REPLICATING THE IGNITION BREAKTHROUGH

The National Ignition Facility replicated or exceeded its groundbreaking fusion ignition of December 2022 three times in 2023. Ignition occurs when more energy is produced from fusion than the laser energy used to drive it. These developments mark critical progress that will advance NNSA's stockpile stewardship program. 19

## ADVANCED SUPERCOMPUTING

At the Los Alamos National Laboratory, diagnostics work has been completed for Crossroads. The system will replace the existing Trinity supercomputer and will be used by all three NNSA labs to support the stockpile stewardship program, current and planned weapons life extension program activities, and future predictive weapons research and calculations. At Lawrence Livermore National Laboratory, critical El Capitan milestones have been authorized, with the completion of the Lease to Own agreement. The lab completed the El Capitan Site Infrastructure project, and the switching infrastructure and cabinets were installed. 20

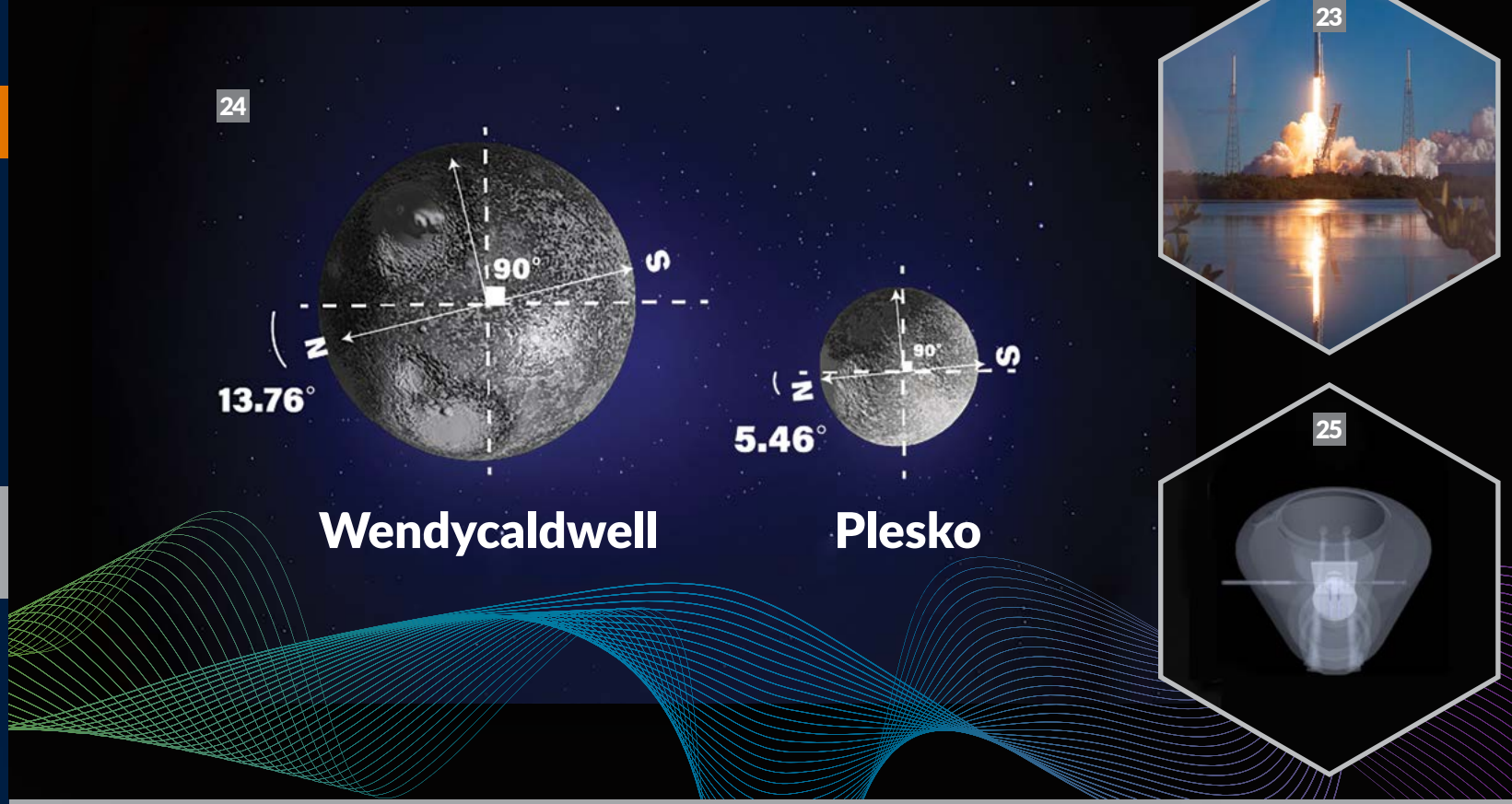



## UNPRECEDENTED NEUTRON DATA

The Chi-Nu physics experiment contributed essential, never-before-observed data for enhancing nuclear security applications, understanding criticality safety, and designing fast-neutron energy reactors. The years-long experiment measures the energy spectrum of neutrons emitted from neutron-induced fission, and concluded detailed uncertainty analyses of uranium-238, uranium-235, and plutonium-239. 21

## NEW LASER SCIENCE

Sandia scientists demonstrated the capability to dynamically steer light pulses from conventional sources, enabling the replacement of power consuming laser beams in several technologies, such as remote sensors and high-speed communications. 22










## COLLABORATION ON GLOBAL BURST DETECTOR

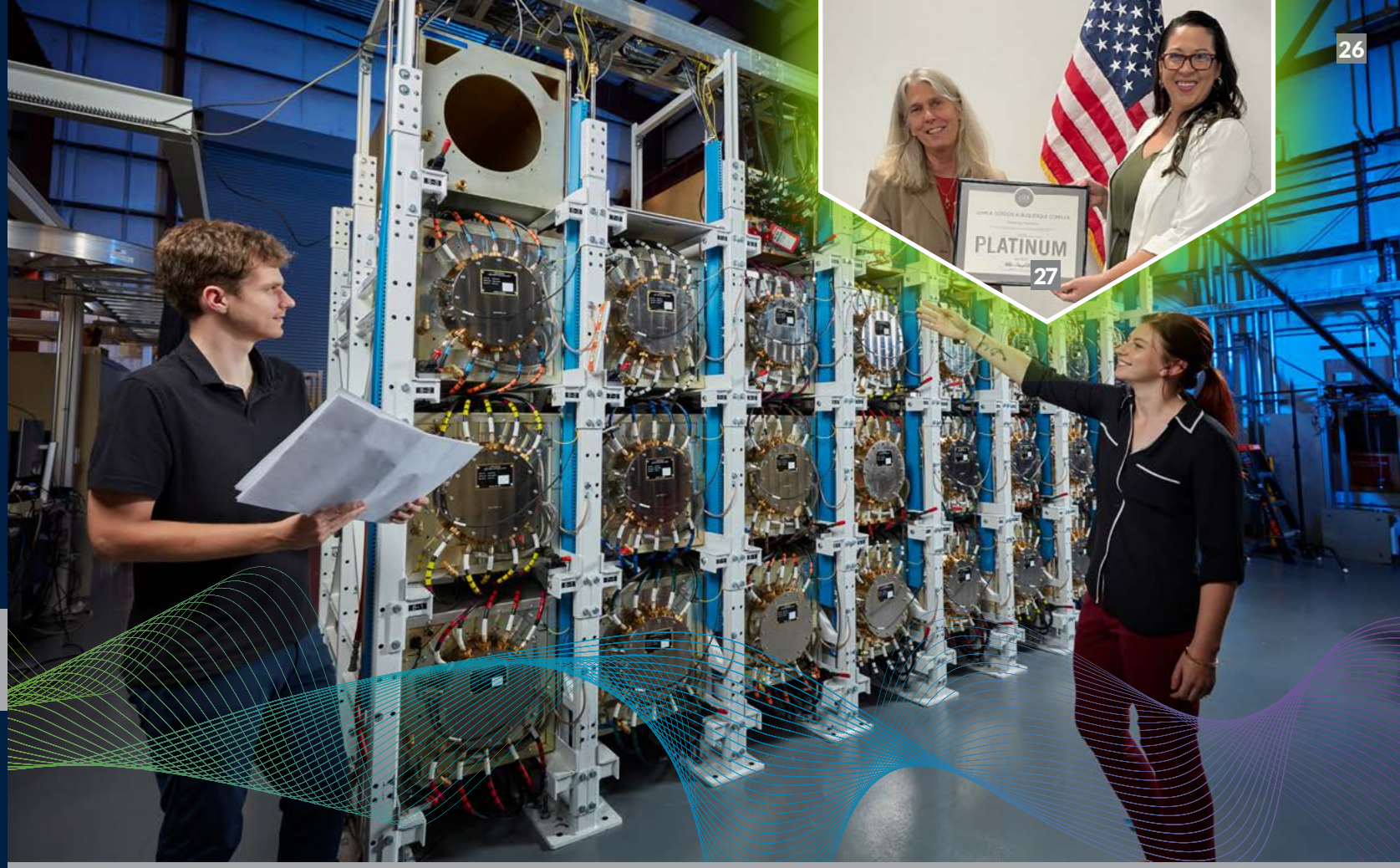
NNSA partnered with the U.S. Space Force to provide the technology for the launch and on-orbit testing of the Global Burst Detector III-06 payload on the Global Positioning System satellite. The GBD III-06 contains radiofrequency, optical, and x-ray sensors designed to detect nuclear explosions, as part of a constellation of space-based sensors. The GBD is a joint effort between Los Alamos National Laboratory and Sandia National Laboratories. 23

## ASTEROIDS AND PLANETARY DEFENSE

Planetary-defense scientists Cathy Plesko and Wendy Caldwell now have asteroids named after them. The Working Group for Small Bodies Nomenclature published the names June 21, 2023 on behalf of the International Astronomical Union, dubbing asteroid 32105 “Plesko” and asteroid 32110 “Wendycaldwell.” 24

## NUCLEAR REACTOR DIGITAL TWINS

Idaho National Laboratory adapted its DeepLynx data warehouse software to develop a digital twin of the Idaho State University AGN-201 reactor, enabling analysis of proliferation indicators and pathways using artificial intelligence. This represents the first ever demonstration of near real-time, secure data streaming of controls and sensor data through a commercial cloud provider for a nuclear reactor digital twin. 25




## SCORPIUS MILESTONES

The Advanced Sources and Detectors Scorpius project at the Nevada National Security Site's PULSE facility will generate high-speed, high-fidelity radiographic images of subcritical experiments. The project reached several key milestones this year: the ribbon cutting for the Electron Beam Injector, groundbreaking for the Integrated Test Stand, and delivery of 24 pulsers powering the electron beam accelerator. 26

## LEED PLATINUM AWARD

NNSA was awarded its first Leadership in Energy and Environmental Design (LEED) Platinum certification for the John A. Gordon Albuquerque Complex facility. On August 7, 2023, the Administrator unveiled the LEED Platinum plaque awarded by the U.S. Green Building Council to the facility. 27


## EXPANDING KCNSC

NNSA leveraged flexible acquisition authorities and met critical equipment procurement milestones to address immediate capacity issues at the Kansas City National Security Campus through the KC Short Term Expansion Plan (KC STEP). NNSA also implemented a lease-purchase strategy to acquire a co-located manufacturing campus at KCNSC to ensure sufficient capacity plus margin in the future. 28

## NAVAL SPENT FUEL HANDLING FACILITY

Over 230,000 cubic yards of concrete (over 23,000 concrete truck loads) were placed for the heavily reinforced concrete foundations of the Naval Spent Fuel Handling Facility in Idaho. The Naval Reactors program also began erecting the steel structure for the main process building. 29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## PIT PRODUCTION MILESTONES

The equipment subproject supporting the production of 30 plutonium pits per year at Los Alamos National Laboratory achieved baseline on schedule. This supports critical storage space that will allow workers to receive, inspect, test, store, integrate, and assemble gloveboxes and other equipment headed to the Plutonium Facility. Meanwhile, the Savannah River Plutonium Processing Facility construction project reached several major milestones for process design, dismantlement and removal of equipment, and contracts for glovebox vending and construction management. 30

## MINORITY SERVING INSTITUTIONS

The Minority Serving Institutions Partnership Program (MSIPP) funded 33 consortia consisting of 56 minority serving institutions: 21 Historically Black Colleges and Universities, 24 Hispanic Serving Institutions, and 11 Tribal Colleges and Universities in collaboration with 14 sites across the Nuclear Security Enterprise. Through the consortium partnerships, MSIPP supported 413 interns. NNSA's workforce programs supported 125 hires into the broader enterprise, including 49 from NNSA's Graduate Fellowship Program and 76 from MSIPP. 31

## MERCURY BUILDING 2 IN NEVADA

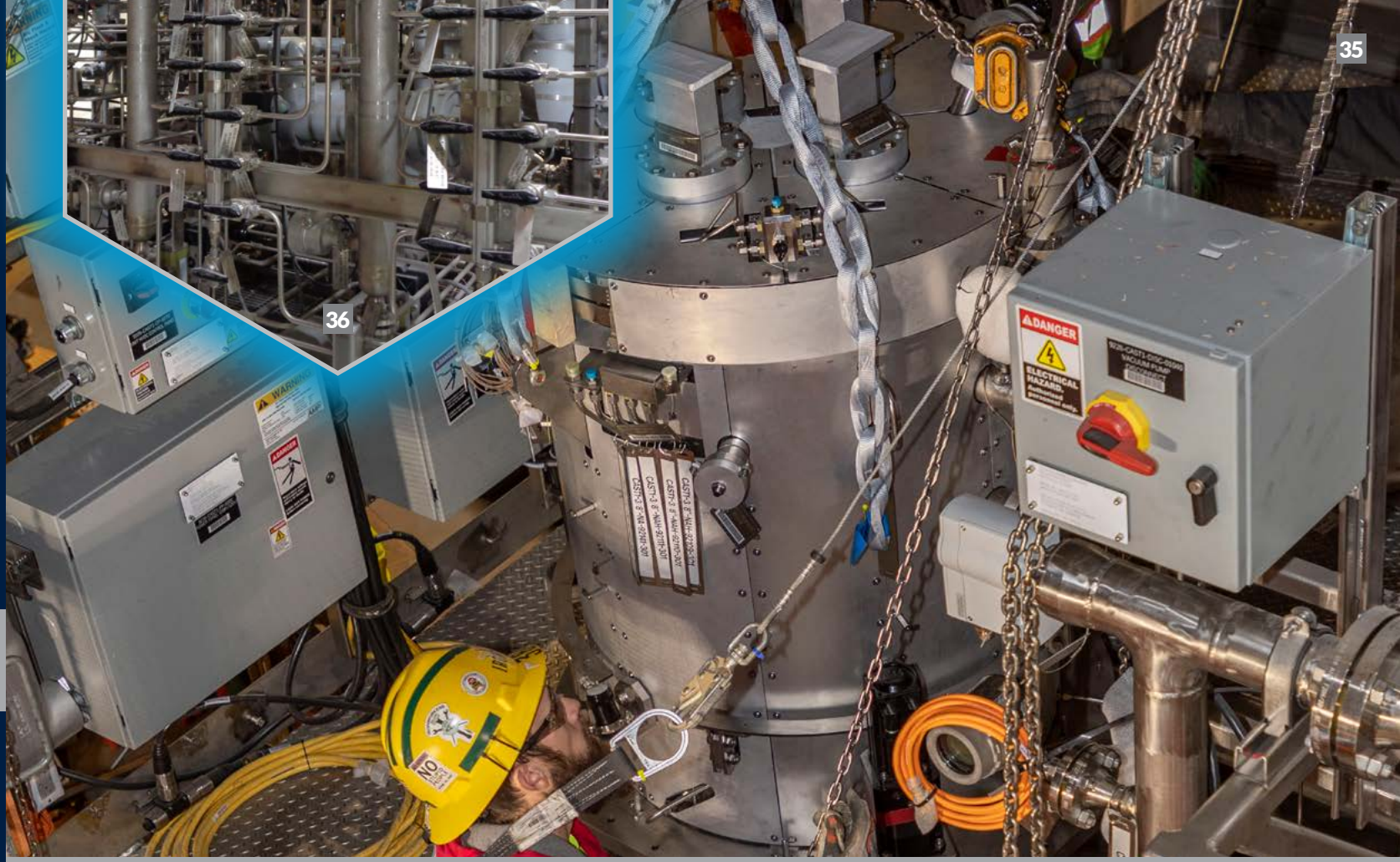
The Nevada National Security Site's Mercury Building 2, dedicated this year, is a state-of-the-art, 13,000-square-foot facility housing the site's Operations Command Center and Emergency Operations Center, including support for Nye County Dispatch. 32

## HIGH EXPLOSIVE SCIENCE AND ENGINEERING FACILITY

Marking significant progress towards completing a co-located facility for performing high explosive science and technology development at Pantex, the High Explosive Science and Engineering (HESE) Facility held a structural steel "topping out" ceremony for the Technology Development and Deployment Laboratory. Placing the uppermost piece of structural steel is a key milestone in building construction. 33

## GROUNDBREAKING AT LITHIUM PROCESSING FACILITY

There was an official groundbreaking for the new, 245,000 square foot Lithium Processing Facility (LPF) at the Y-12 National Security Complex. It will replace a nearly 80-year-old facility ensuring the continuity of lithium capabilities, reducing annual operating costs, and increasing process efficiencies using safer and more agile equipment. It will also feature updated technology to support a new lithium process. 34

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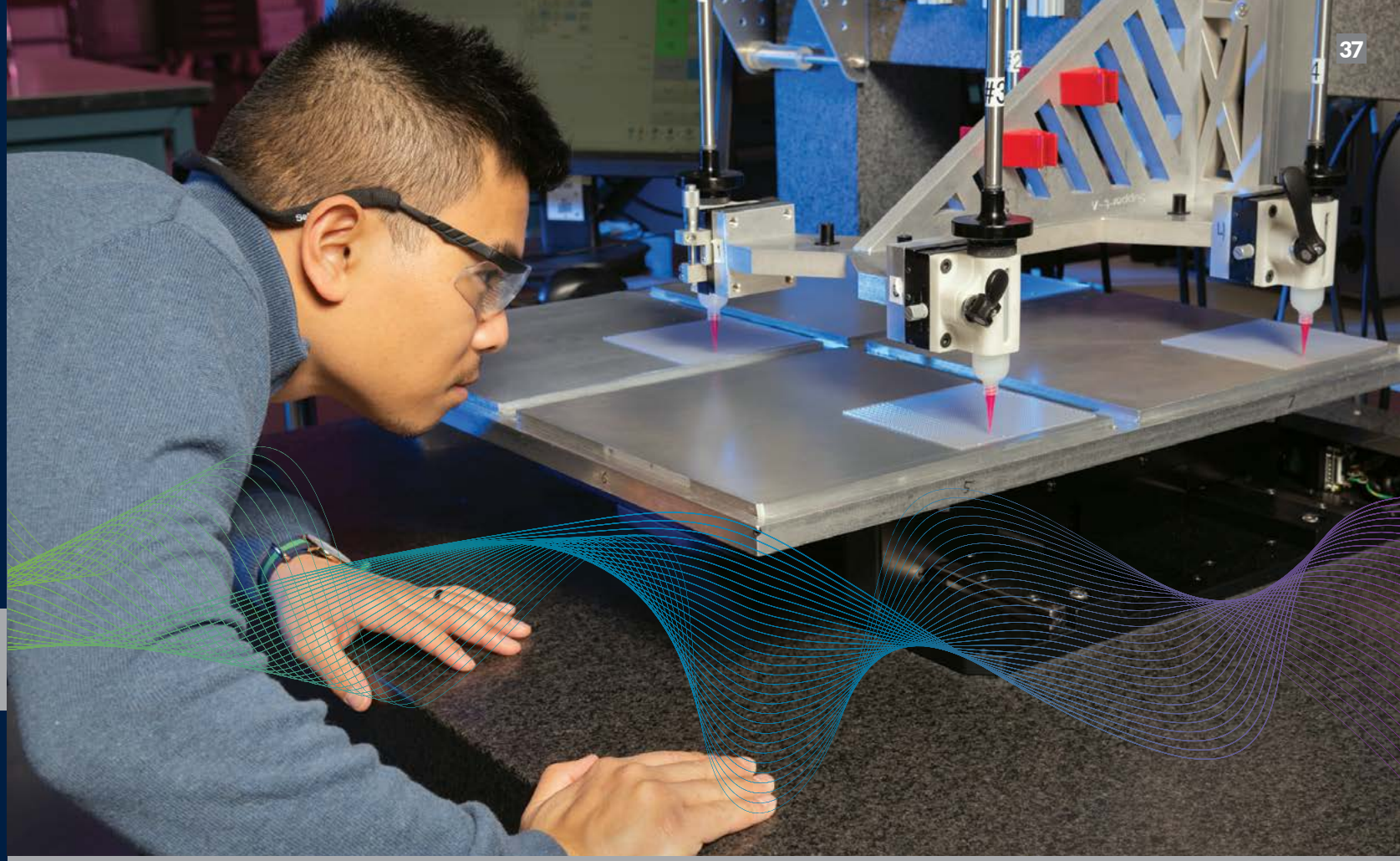
## EQUIPMENT FOR URANIUM PROCESSING FACILITY

In 2023, the Uranium Processing Facility (UPF) at the Y-12 National Security Complex saw the delivery and staging of the four Microwave Casting Furnaces in the Main Process Building. This equipment will improve current Y-12 processes with greater quality control and better protection during production processing. Upon delivery of this key equipment, UPF deliveries were over 96% complete. 35

## UPF'S SALVAGE AND ACCOUNTABILITY BUILDING

All major equipment was delivered and installed in the 127,000 square foot Salvage and Accountability Building (SAB), part of the UPF. This includes 106 skids, 3 gloveboxes, and 2 walk-in enclosures. UPF crews worked 824 days without a lost-time incident and the project ended the fiscal year 70.3% complete. SAB will house chemical recovery and calcination, and will also provide waste preparation and decontamination for the Y-12 National Security Complex. 36



## INNOVATION IN INFRASTRUCTURE

The Kansas City National Security Campus' Supply Chain Management Center was awarded an Excellence Gold Award by NNSA's Office of Infrastructure for its innovative construction and infrastructure services support strategy. Initiatives in FY 2023 resulted in $439 million in total cost savings across NNSA and DOE's Office of Environmental Management.

## CONNECTED FACTORY TECHNOLOGY

KCNSC deployed fully operational connected factory architecture to produce polymer additive manufacturing pads and cushions, eliminating the need for manual file transfer and manual verification operations. This included the use of Machine Application Programming Interface to orchestrate the centralized management and distribution of configuration data, which alone saved $23,000 in FY 2023. 37

## IMPROVED APPROACH TO CONTRACTING

Stemming from the Enhanced Mission Delivery Initiative (EMDI), NNSA has improved its approach to contracting and procurement in concrete ways. By bringing together its community of contracting officers and M&O partners, NNSA has implemented a risk-based oversight approach for contracting and procurement, and streamlined the federal review and approval process from an average of 26 days to an average of 7 days, saving 3 weeks in the process.

## SUCCESSFUL CONTRACTING ACTIONS

Partnership & Acquisition Services shepherded the successful execution of over $19.8 billion in obligations in FY 2023, and 2,075 actions.

## IMPROVEMENTS FOR PROTECTIVE FORCES

Marking the first time all NNSA's protective force members have used the same weapons platform, NNSA leveraged an existing contract the U.S. Marine Corps had with a manufacturer to advance M-27 weapons deployment across the Nuclear Security Enterprise. By streamlining an otherwise cumbersome procurement process, this realized nearly $1.5 million in cost savings and/or avoidance. 38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## DEVELOPING AN ENTERPRISE BLUEPRINT

NNSA launched the development of an Enterprise Blueprint, which will define NNSA's integrated priorities for the capabilities to achieve needed capacity, resilience, and responsiveness across the distributed enterprise. A clear and well-understood vision of NNSA's future will support both near-term execution and longer-term planning.

## FINAL RFP FOR PANTEX

NNSA released the highly anticipated final Request for Proposals (RFP) for the Pantex Plant Management and Operating Contract competition. The value of the contract is approximately $30 billion over 20 years. NNSA undertook significant engagement with industry prior to the release of the final RFP and hosted an unclassified tour of Pantex.

## ADVISORY COMMITTEE FOR NUCLEAR SECURITY

NNSA demonstrated its commitment to delivering comprehensive, independent studies in core mission areas by launching the Advisory Committee for Nuclear Security (ACNS) as the principal federal advisory committee for the Administrator. 39

## APPROVALS FOR MEDICAL DEVICES

NNSA established an enterprise framework to conduct risk assessments and grant approvals of Medically Necessary Portable Electronic Devices, to ensure approvals are now capable of meeting reasonable accommodations timelines.





## ADMINISTRATOR'S STRATEGY FORUMS

Policy and Strategic Planning coordinated five Administrator's Strategy Forums (ASFs) to discuss a range of current and emerging challenges. Distinguished speakers included Thomas Wright of the National Security Council, Angela Stent of Georgetown University, Kathryn Huff of DOE's Office of Nuclear Energy, author Peter Singer, and Togzhan Kassenova of the Carnegie Endowment for International Peace. 40

## PREPARATION FOR SITE TRANSITION

NNSA worked collaboratively with DOE's Office of Environmental Management to prepare the FY 2025 Savannah River Site Landlord Transition from DOE to NNSA. This complex project includes oversight of 18 subgroups covering more than $200 million and approximately 100 federal and support service contractor employee positions. 41

## EMERGENCY MANAGEMENT PLANNING

NNSA's Office of Emergency Management released its Strategic Plan for Fiscal Years 2024-2028. It outlines newly realigned program areas and explains efforts to improve organizational health, realign finite resources to the three lines of business, and deliver excellent customer service.


## STREAMLINING PROCESSES

The Enhanced Mission Delivery Initiative (EMDI) Stockpile Modernization Working Group improved processes for the W80-4 Life Extension Program, W87-1 Modification Program, and the W93 Program. The pilot program's initial actions focused on updating roles and responsibilities in warhead product realization teams, design reviews, and production readiness reviews. The clarified roles and responsibilities helped improve working relationships, streamline processes, and avoid duplication in the warhead modernization portfolio.

## TRANSURANIC WASTE SHIPMENTS

67 shipments of transuranic waste were completed, with a total of 760 containers or drums. Current storage volume is at 28%, allowing space for the ongoing production mission. 42

## LLNL ENVIRONMENTAL IMPACT

The Final Lawrence Livermore National Laboratory Site Wide Environmental Impact Statement (EIS) was approved. The EIS provides an analysis of the potential environmental impacts of two reasonable approaches to continuing laboratory operations for the next 15 years.

## ARMS CONTROL ADVANCEMENT

As part of the Arms Control Advancement Initiative, NNSA launched the Next Generation Arms Control Experts program which seeks to attract, retain, and support relevant arms control monitoring and verification expertise. 43

## ADVANCED MICROELECTRONICS

KCNSC showed it could make advanced microelectronics "chip" packages for future nuclear weapon programs and global security applications through a recent Plant-Directed Research and Development effort that fulfills one of the most significant national need areas relative to the semiconductor supply chain.

## OPERATIONAL TECHNOLOGY PILOT

NNSA implemented an operational technology pilot across the Nuclear Security Enterprise that monitors and reports asset information across five sites to maintain cybersecurity and compliance.

## NEW PERFORMANCE RATING SYSTEM

At the request of NNSA managers, Human Resources implemented a 5-tier performance rating system. The new rating system now includes Exceeds Expectations, a rating between Fully Meets Expectations and Significantly Exceeds Expectations. The new rating level enables supervisors to further differentiate individual performance.





## VEHICLE FLEET OF THE FUTURE

Lawrence Livermore National Laboratory replaced 73% of light-duty vehicles with zero-emission vehicles, earning the DOE Office of Management's Green Fleet Award. By modernizing and decarbonizing their vehicle fleet, the lab supports the Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability Executive Order. 44

## ENERGY PERFORMANCE CONTRACTS

NNSA advanced implementation of Energy Performance Contracts at three NNSA sites: Sandia National Laboratories, Pantex Plant, and Y-12 National Security Complex. Work includes determining which energy conservation measures are cost-effective and solidifying cooperation with state and local authorities. 45

## URANIUM RESERVE FOR UKRAINE

Since the full-scale Russian invasion of Ukraine, the U.S. government sought to establish a uranium reserve program. NNSA executed two procurements: the first to purchase approximately one million pounds of uranium concentrate as uranium oxide, the second to convert approximately one million pounds of uranium oxide into uranium hexafluoride. Converting uranium oxide into uranium hexafluoride is required for the process of enriching uranium in order to fuel nuclear reactors and support tritium production.

National Nuclear Security Administration